Space Weather Technical Forecast

Issued on Sunday, 06 November 2022 at 01:04 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Slight chance G1/minor storms from day 2 (7th-9th). Slight chance of M-Class flares. Active fluence (1e8 integrated pfu) likely through much of the period.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low through the last 24 hours, with a few low level C-class flares observed in the past 24 hour period. There are eight active regions, which are mainly covering the northern hemisphere. AR3141 in the northeast is by far the largest and most complex region on the disk, with large leading and trailing spots. AR3140 in the northeast is the second largest region, with a single moderately sized mature spot. Two moderately sized regions reside in the northwest quadrant, AR3131 and AR3135, which appear to be stable. All other active regions are small and simple. No significant Earth-directed CMEs have been identified in recent imagery.

Solar Wind / Geomagnetic Activity: The solar wind, observed by DSCOVR at L1, is showing a declining influence from coronal hole 39 with speeds declining from 500km/s to 450km/s. Density fell from average to below average. Total magnetic field strength, IMF, has been weak with a declining trend. The north-south component, Bz has varied weakly, with a mostly negative bias noted. Phi angle has been mostly positive (away from the Sun). Geomagnetic activity has fallen from Unsettled and Active (Kp 3-4) to Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2 MeV) at GOES-16 has remained at high levels, reaching a peak of 8.03e3 pfu at 05/1615UTC. Electron fluence levels have steadily risen to reach 3.71e8 integrated pfu at 06/0000 UTC, with further rises in the past 12 hours.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be mainly Low, with a slight chance of Moderate activity. There also remains a risk from further regions rotating onto the disc from the far side of the Sun.

Solar Wind / Geomagnetic Activity: No Earth directed CMEs feature in the forecast. The high speed stream from coronal hole 39 is expected to decline to slow-ambient levels by the end of day 1 (6th). Coronal hole 42 may then connect with the Earth either later on day 2 (7th) or during day 3 (8th), although there is low confidence in the strength of any connection. There is a chance that earth may connect to coronal holes 40 or 41 on day 4 (9th), though their impact on earth is expected to be minimal due to their negative polarity. Geomagnetic activity is expected to be mainly Quiet to Unsettled, but there is a slight chance of Active or G1/Minor Storm intervals from day 2 onward (7th-9th) due to successive arrivals of coronal hole fast winds.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) observed by GOES-16 is expected to be at background levels. High energy electron flux (greater than 2MeV) is expected to remain mainly above the high threshold through much of the period,

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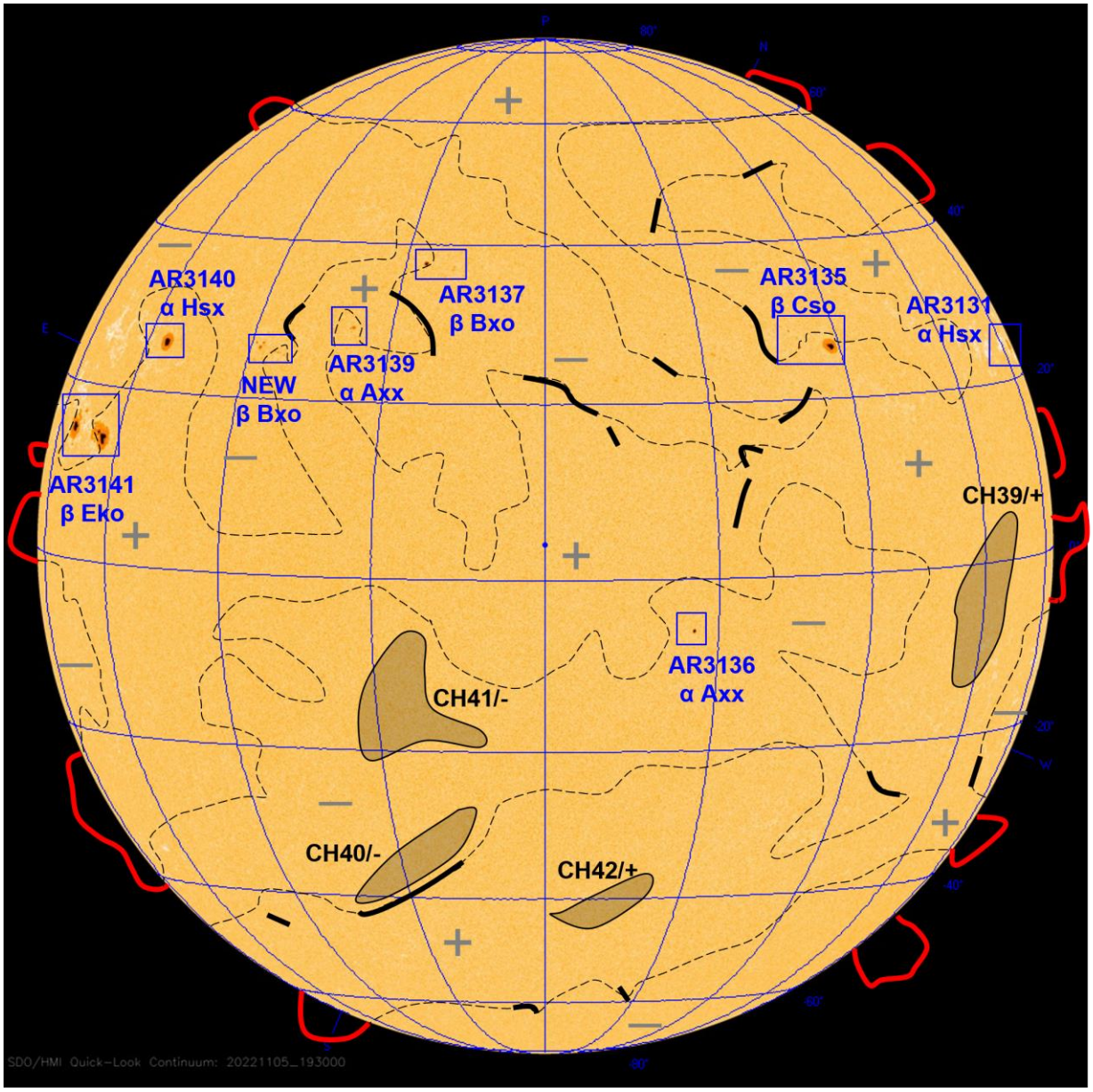
with a declining trend and brief sharper drops and recoveries due to the diurnal orbital cycle. Electron fluence values are expected to remain above the Active (1e8 integrated pfu) threshold through the period due to elevated electron flux values, with a slight chance of reaching Very High (1e9 integrated pfu) levels through the period.

Figure 1. Solar Analysis Valid 05/2000 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

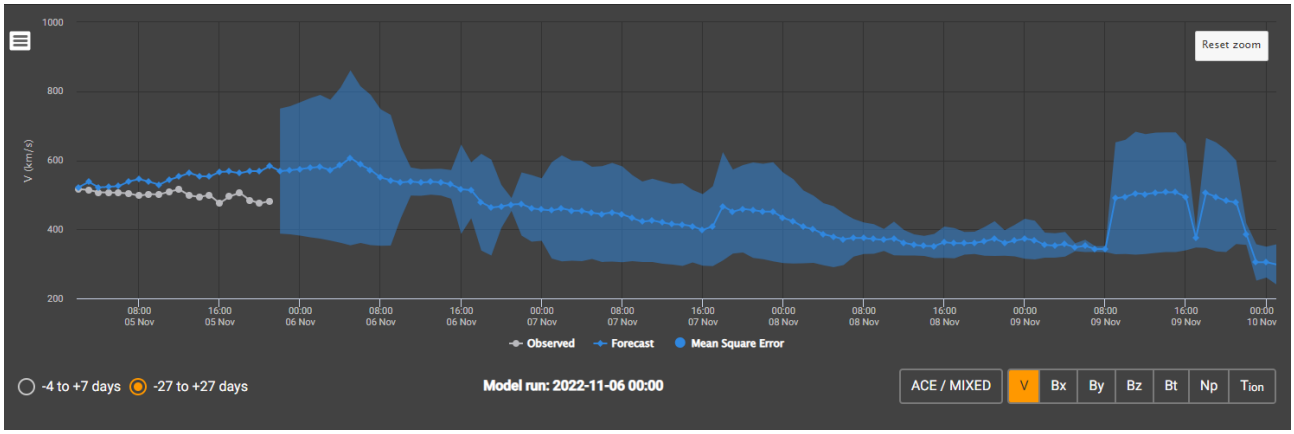
No Earth directed CMEs feature in the forecast.

The high speed stream from CH39+ is waning ad should continue to do so over coming days. Coronal hole 42 may then connect with the Earth either later on day 2 (7th) or during day 3 (8th), although there is low confidence in the strength of any connection. There is a chance that earth may connect to coronal holes 40 or 41 on day 4 (9th), though their impact on earth is expected to be minimal due to their negative polarity as we slowly edge away from the autumn equinox.

Geomagnetic activity is expected to be mainly Quiet to Unsettled, but there is a slight yet increasing chance of Active or G1/Minor Storm intervals from day 2 onward (7th-9th) due to successive arrivals of coronal hole fast winds.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	10	10	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: SWPM forecast, showing likely downward trend over the next 4 days, with the next most likley enhancement on 9th.



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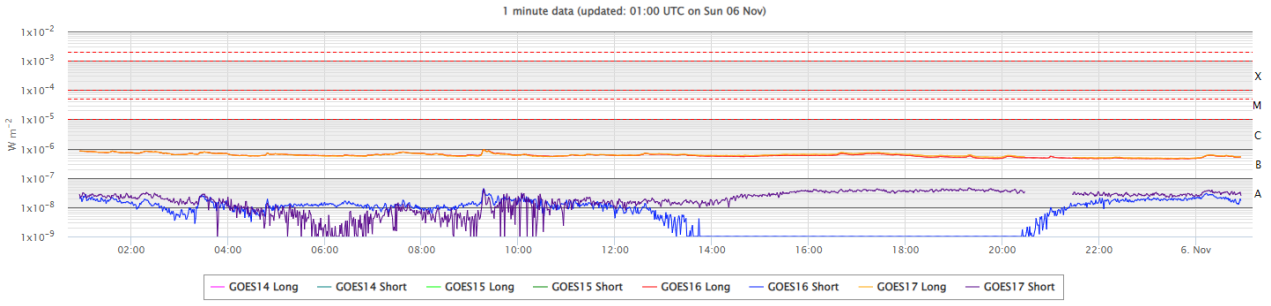
Radio Blackouts - X-Ray Flares:

There are seven numbered active regions on the visible disc, with an unnumbered region in the northeast. AR3141 in the northeast is by far the largest and most complex region on the disk, with a reclassification to suit it's length and size of both the leading and trailing spots. AR3140 in the northeast is the second largest region, with a single moderately sized mature spot. There are two more moderately size spots in the northeastern hemisphere, AR3131 disappearing around the northwestern limb and AR3135, both showing little change. All other sunspots are small and simple.

Solar activity has been Low, with only minor low level C-class flares observed. Activity is likely to be Low or Very Low, with a slight (20%) chance of an isolated M-class flare, this most likely originating from AR3141.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	20	20	20	20
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: 24 hour X-Ray trace.



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) at GEO, observed by GOES-16 is currently at background levels and is forecast to remain at this level through the guidance period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) has remained at high levels over the past 24 hours with this likely to continue as a result of the recent input into the radiation belts. This is only likely to decrease slowly through the next four days, with no significant geomagnetic activity expected. Brief declines are possible due to diurnal variations, but these are unlikely to be sustained.

Electron fluence has risen sharply in response to the increase flux and is expected to remain above the Active threshold (1e8 integrated pfu) for much of the period. The risk is considered lower towards the end of the period simply due to reduced confidence in any geomagnetic activity and rate of electron losses in the radiation belts.

There remains a slight chance of reaching Very High (1e9 integrated pfu) levels through the period, but again this is on a declining trend throughout.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	100	90	80	70
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	20	20	10	10

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Figure 5: 24 hour electron Flux trace and REFM fluence forecast models, persistence and observations.

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